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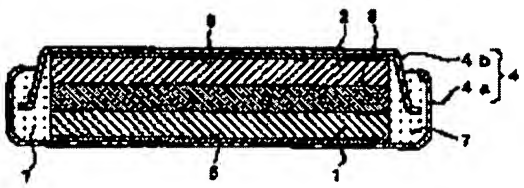
(54) LITHIUM SECONDARY BATTERY FOR SUBSTRATE MOUNTING

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a lithium secondary battery for substrate mounting in which liquid leakage is hard to occur and internal resistance does not rise greatly at the time it is heated to high temperature by a re-flow treatment or the like.

SOLUTION: The lithium secondary battery for substrate mounting used for mounting on a substrate consists of a positive electrode 1, a negative electrode 2 which consists of an alloy containing lithium and aluminium, and a non-aqueous electrolyte which consists of a solution and a solvent. The solvent contains propylenecarbonate and diethyleneglycoldialkyl ether. It may preferably added by trialkyl phosphate.



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* NOTICES *

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2.**** shows the word which can not be translated.
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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the lithium secondary battery for substrate wearing with which a substrate is especially equipped by reflow processing etc. about the lithium secondary battery for substrate wearing with which a substrate is equipped.
[0002]
[Description of the Prior Art] A lithium secondary battery is small and lightweight, and its energy density is high, and it is excellent in the preservation property. From this, the lithium secondary battery is widely used from before as the main power supply of various electronics devices, or a power source for memory backup.
[0003] When using a lithium secondary battery as a power source for memory backup, the method of mounting a lithium secondary battery in substrates, such as a printed circuit board, directly is widely adopted so that it may stabilize and operate over a long period of time.
[0004] Thus, when making a lithium secondary battery mount in substrates, such as a printed circuit board, attaching the end section of the metal lead plate for current drawing in the external terminal side of a lithium secondary battery by spot welding or laser welding, making it insert in the terminal hole in which the other end of this metal lead plate was prepared by substrates, such as a printed circuit board, and soldering is performed.
[0005] When the other end of the metal lead plate attached in the external terminal side of a lithium secondary battery as mentioned above was soldered to a substrate, the activity soldered separately had problems, like it is troublesome, productivity worsens and cost becomes high.
[0006] For this reason, in recent years, after applying a cream pewter to the part of the substrate furnished with a lithium secondary battery and putting a lithium secondary battery on the spreading side of a cream pewter, a lithium secondary battery is led to a reflow furnace together with a substrate, into this reflow furnace, short-time heating is carried out at an about 230-270-degree C elevated temperature, melting of the pewter is carried out, and automatic soldering which attaches a lithium secondary battery with other electronic parts at a substrate is tried. This the processing of a series of is called reflow processing.
[0007] However, when leading a lithium secondary battery to a reflow furnace and making a substrate equip with it with a substrate, a lithium secondary battery is also put to a 230-270-degree C elevated temperature. For this reason, on the occasion of reflow processing, the intense reaction arose by the heat history among cell ingredients, such as a positive electrode in a lithium secondary battery, a negative electrode, nonaqueous electrolyte, and a separator, the internal pressure of a lithium secondary battery rose by this, the liquid spill arose and there was a problem of the internal resistance of a lithium secondary battery rising greatly.
[0008] For this reason, in JP,2000-40525,A and JP,2000-48859,A, preventing that control that nonaqueous electrolyte evaporates the lithium salt which has a sulfone radical using the nonaqueous electrolyte which dissolved the sulfolane or 3-methyl sulfolane in the organic solvent used as a principal

component in the case of reflow processing, and the internal pressure of a cell rises is proposed.
[0009]
[Problem(s) to be Solved by the Invention] However, also when the approach of the above-mentioned official report was used, there was a problem that the amount of the sulfolane used for the solvent of nonaqueous electrolyte cannot be suitable, or the conductivity of nonaqueous electrolyte can fall greatly, the charge-and-discharge property in a lithium secondary battery can worsen if the class of solvent mixed with a sulfolane is not suitable, or high temperature oxidation stability in a lithium secondary battery could not fully be raised.
[0010] When the purpose of this invention is heated by the elevated temperature by reflow processing etc., it is to offer the lithium secondary battery for substrate wearing with which it is hard to produce a liquid spill, and internal resistance does not rise greatly.
[0011]
[Means for Solving the Problem] This invention is a lithium secondary battery for substrate wearing with which a substrate is equipped, it has a positive electrode, the negative electrode which consists of an alloy containing a lithium and aluminum, and nonaqueous electrolyte which consists of a solute and a solvent, and the above-mentioned solvent is characterized by including propylene carbonate and the diethylene-glycol dialkyl ether.
[0012] While using the solvent containing propylene carbonate and the diethylene-glycol dialkyl ether according to this invention, even if it is heated by the about 230-270-degree C elevated temperature by reflow processing etc. by using the negative electrode which consists of an alloy containing a lithium and aluminum, it can control that nonaqueous electrolyte reacts with a positive electrode and a negative electrode, especially a negative electrode. Consequently, it can control that the internal pressure of a cell rises and generating of a liquid spill can be prevented. Furthermore, since the rise of the internal resistance of a cell can be controlled, a charge-and-discharge cycle property can be raised.
[0013] Although the conductivity of nonaqueous electrolyte becomes low, a charge-and-discharge property worsens, although high temperature oxidation stability becomes it high that the reason for using the solvent containing both propylene carbonate and the diethylene dialkyl ether in this invention is only propylene carbonate, the conductivity of nonaqueous electrolyte becomes it high that it is only the diethylene-glycol dialkyl ether on the other hand and a charge-and-discharge property becomes good, it is because high temperature oxidation stability worsens.
[0014] It is desirable that it is the range of 3 - 50 volume % from a viewpoint of raising the conductivity of nonaqueous electrolyte, and it is still more desirable that it is the range of 5 - 40 volume % while the content rate of the propylene carbonate in a solvent raises the high temperature oxidation stability of nonaqueous electrolyte. Therefore, as for the content rate of the diethylene dialkyl ether, it is desirable that it is the range of 97 - 50 volume %, and it is desirable that it is the range of 95 - 60 volume %.
[0015] By using the negative electrode which consists of an alloy containing a lithium and aluminum, the reaction of the nonaqueous electrolyte and the negative electrode containing the above-mentioned solvent can be controlled also in an about 230-270-degree C elevated temperature. Although it is not clear about the detail of this reason, the coat by the above-mentioned solvent is formed in the front face of a negative electrode, and it is thought that hot stability improves with this coat.
[0016] As an example of the diethylene dialkyl ether, diethylene-glycol wood ether, diethylene-glycol diethylether, diethylene glycol-di-n-propyl ether, etc. are mentioned. These may be used independently, and it may mix and they may be used.
[0017] In other aspects of affairs of following this invention, phosphoric-acid trialkyl is further contained in the above-mentioned solvent. Therefore, the solvent containing propylene carbonate, the diethylene-glycol dialkyl ether, and phosphoric-acid trialkyl is used.
[0018] By containing phosphoric-acid trialkyl in a solvent further, high temperature oxidation stability can be raised further. That is, also in still higher temperature, the liquid spill by the rise of cell internal pressure can be prevented, the rise of the internal resistance of a cell can be controlled, and a charge-and-discharge cycle property can be raised further.
[0019] As for the content rate of the phosphoric-acid trialkyl in a solvent, it is desirable that it is 0.1 -

10% of the weight of the range to the total quantity of propylene carbonate and the diethylene-glycol dialkyl ether, and it is still more desirable that it is 0.5 - 5% of the weight of the range. While raising the high temperature oxidation stability of nonaqueous electrolyte further by considering as such range, a charge-and-discharge cycle property can be raised further.

[0020] Although it is not clear for details about the reason whose high temperature oxidation stability improves further by using the solvent which contains phosphoric-acid trialkyl further, a good coat is formed on the front face of a negative electrode with the solvent containing propylene carbonate, the diethylene-glycol dialkyl ether, and phosphoric-acid trialkyl, and it is thought that high temperature oxidation stability improves further with this coat.

[0021] Especially as phosphoric-acid trialkyl, although not limited, the thing of 1-5 is preferably used for the carbon number of an alkyl group. Also in these, trimethyl phosphate and phosphoric-acid triethyl are desirable, and especially trimethyl phosphate is desirable.

[0022] In the lithium secondary battery of this invention, a manganic acid ghost is especially used preferably as an active material of a positive electrode. As a manganic acid ghost, what has the crystal structure of a spinel mold is desirable. By using a manganic acid ghost as an active material of a positive electrode, the reaction of a positive electrode and nonaqueous electrolyte can be controlled further, and a charge-and-discharge cycle property can be raised further.

[0023]

[Embodiment of the Invention] Hereafter, the lithium secondary battery concerning the operation gestalt of this invention is explained concretely. However, the lithium secondary battery of this invention is not limited to the following operation gestalten, in the range which does not change the summary, can be changed suitably and can be carried out.

[0024] Drawing 1 is the typical sectional view showing the lithium secondary battery of 1 operation gestalt of this invention. As shown in drawing 1 , the separator 3 which infiltrated nonaqueous electrolyte between the positive electrode 1 and the negative electrode 2 is made to intervene, and it is contained in the cell case 4 which consists of this condition by positive-electrode case 4a and negative-electrode case 4b. The positive electrode 1 is connected to positive-electrode case 4a through the positive-electrode charge collector 5. The negative electrode 2 is connected to negative-electrode case 4b through the negative-electrode charge collector 6. Where positive-electrode case 4a and negative-electrode case 4b are electrically insulated with the gasket 7 which is insulating packing, the closure of the positive-electrode case 4a is carried out in total, and the lithium secondary battery of a coin mold is constituted.

[0025] In this operation gestalt, a positive electrode 1 mixes positive active material, an electric conduction agent, and a binder, and what fabricated this is used. The well-known transition-metals oxide currently generally used in the lithium secondary battery as positive active material can be used. For example, although a titanic-acid ghost, a banazin san ghost, a manganic acid ghost, cobalt oxide, a nickel oxide, a niobic acid ghost, a molybdic-acid ghost, etc. can be used, it is desirable to use a manganic acid ghost especially as mentioned above. Moreover, by using the manganic acid ghost which has the crystal structure of a spinel mold as mentioned above, it can control further that a positive electrode and nonaqueous electrolyte react in an elevated temperature, and the high temperature oxidation stability and the charge-and-discharge property of having excelled further can be acquired.

[0026] The well-known thing currently generally used in the lithium secondary battery as an electric conduction agent used for a positive electrode 1 can be used. For example, natural graphites, such as a scale-like graphite and an earthy graphite, an artificial graphite, carbon black, acetylene black, KETCHIEN black, a carbon fiber, etc. can be used. In order to raise a charge-and-discharge property further, it is desirable to double and use a graphite and acetylene black as an electric conduction agent. It is desirable to use what mixed a graphite and acetylene black by the weight ratio of 3 / 7 - 7/3 especially.

[0027] The well-known thing currently generally used in the lithium secondary battery as a binder used for a positive electrode 1 can be used. For example, a polytetrafluoroethylene, polyvinylidene fluoride, polyvinyl-pyrrolidone, polyvinyl chloride, polyethylene, polypropylene, poly fluoro ethylene propylene,

and ethylene-propylene-JIENTA polymer, styrene butadiene rubber, a carboxymethyl cellulose, a fluororubber, etc. can be used. Since it is especially heated by about 230-270 degrees C in the case of reflow processing, it is desirable to use poly fluoro ethylene propylene excellent in high temperature oxidation stability. As for the addition of poly fluoro ethylene propylene, it is desirable that it is 1 - 10% of the weight of the range.

[0028] In order to control a reaction with nonaqueous electrolyte as a negative electrode 2 in the case of reflow processing, the alloy containing a lithium and aluminum is used. As for the rate of a lithium and aluminum, it is desirable that it is 1:5-1:2 in a mole ratio. In addition, other elements, such as lead, tin, magnesium, and manganese, may be included in the range in which high temperature oxidation stability and a charge-and-discharge property are not reduced in addition to a lithium and aluminum.

[0029] In order to control a reaction with the nonaqueous electrolyte in the case of reflow processing as a separator 3, it is desirable to use a polyphenylene sulfide. In addition, in the range in which thermal stability is not reduced, since the high resin of other thermal stability is mixed or reinforcement is raised, it is also possible to mix an inorganic fiber or cellulosic resin.

[0030] What dissolved the suitable solute in the solvent containing propylene carbonate and the diethylene-glycol dialkyl ether or the solvent containing propylene carbonate, the diethylene-glycol dialkyl ether, and phosphoric-acid trialkyl as nonaqueous electrolyte into which a separator 3 is infiltrated is used.

[0031] In the solvent of nonaqueous electrolyte, solvents other than the above-mentioned solvent may be mixed in the range in which a property is not reduced.